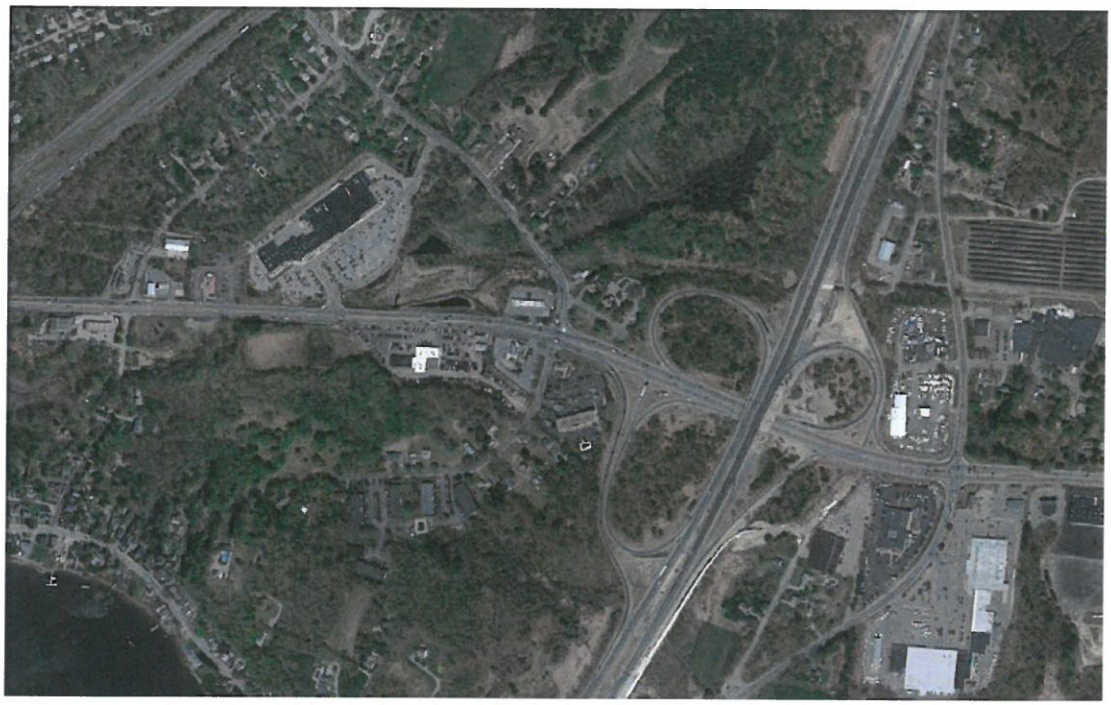
Traffic Impact and Access Study

# AMESBURY CHEVROLET
# PROPOSED ADDITION
# 103 Macy Street



**Amesbury, MA**
**March 21, 2016**


Prepared by:

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Prepared for:

**Three Way Realty Trust**

# TRAFFIC IMPACT AND ACCESS STUDY

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*Prepared for:*

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# SECTION 1: EXECUTIVE SUMMARY

Bayside Engineering has prepared this study to assess the traffic impact and to evaluate the access requirements of the proposed expansion of Amesbury Chevrolet located at 103 Macy Street in Amesbury, Massachusetts.

This report identifies existing traffic operating parameters on key roadways and intersections within the study area, evaluates the anticipated traffic volume increases as a result of the proposed project, analyzes the project's traffic-related impacts, determines the projects access/egress requirements and identifies appropriate mitigating measures designed to minimize the traffic-related impacts created by the project. The following provides a brief summary of the study findings.

## PROJECT DESCRIPTION

The existing Amesbury Chevrolet dealership is located along the south side of Macy Street west of the intersection of Elm Street and Clarks Road in Amesbury, MA. Currently, the site consists of two buildings used in the sale and repair of automobiles comprising approximately 19,072 gross square feet (gsf) of space. Access to Macy Street is currently provided to the existing buildings by way of one full-movement driveway. There are currently five curb-cuts to Macy Street, but only one is used for access to the dealership.

As currently proposed, the project will consist of razing of the existing building in the northeast corner of the site and the construction of a new addition to the building. The addition will be approximately 16,000 gsf of space and will contain twenty-three (23) service bays. Access to the site will continue to be provided by way of the existing main driveway to Macy Street and a secondary, a service driveway, will be located at the easterly edge of the site. The service driveway is designed for delivery of parts and other materials associated with the sale and repair of automobiles. The remaining site curb-cuts will be closed with the exception of the westernmost curb cut which provides access to the undeveloped property immediately west of the site on Macy Street. Figure 1 shows the site location in relation to the surrounding area.

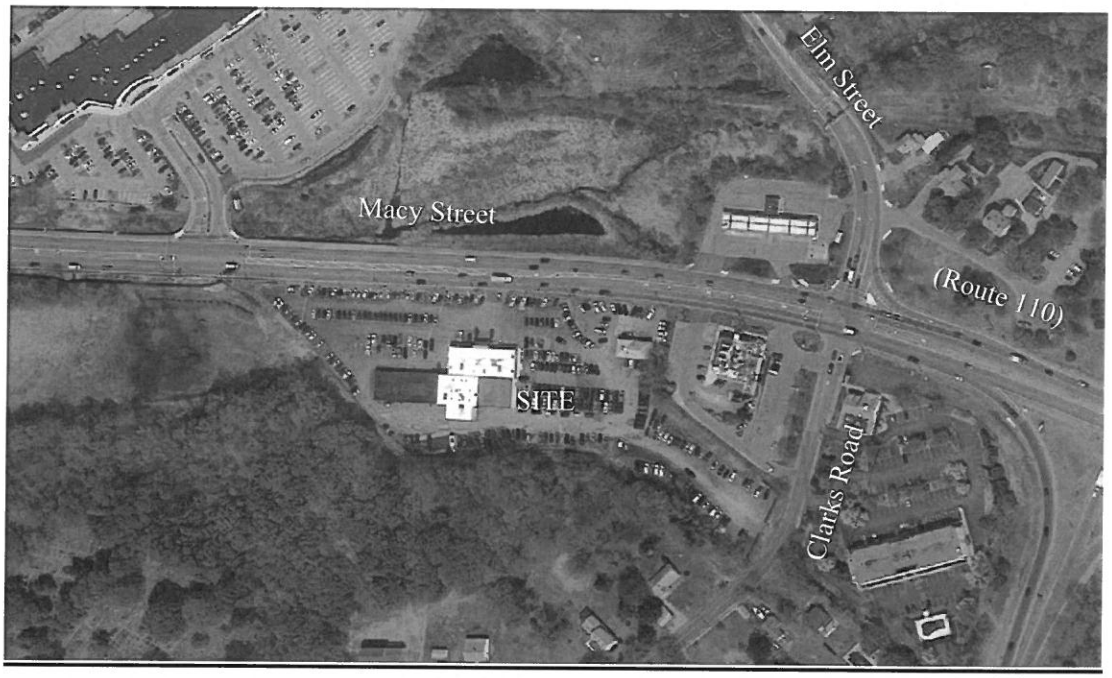


**Figure 1**
**Site Location Map**

## STUDY METHODOLOGY

This study has been prepared in three stages. The first stage involved an assessment of existing conditions within the study area and included an inventory of roadway geometrics, pedestrian and bicycle facilities and public transportation services. Existing traffic counts were performed at the study area intersections.

In the second stage of the study, future traffic conditions were projected and analyzed. Specific travel demand forecasts for the project were assessed along with future traffic demands due to expected traffic growth independent of the proposed project. In accordance with Massachusetts Department of Transportation (MassDOT) guidelines, the year 2023 was selected as the basis for modeling future transportation impacts of the proposed development to reflect a the opening year conditions and a seven-year planning horizon.

The third stage of the study presents and evaluates measures to address traffic issues, if any, and necessary improvements to accommodate the development.

## STUDY AREA

Roadway geometry and traffic control information was collected for the following locations:

- Macy Street, Elm Street and Clarks Road
- Macy Street and existing main site driveway

## EXISTING CONDITIONS

Evaluation of existing conditions within the study area includes a description of roadway geometrics, traffic constraints, land uses at the intersections, and quantification of traffic volumes.

### Existing Traffic Volumes

To establish base traffic conditions within the study area, manual turning movement and vehicle classification counts were obtained in February 2016. Peak-period turning movement counts were conducted during the weekday morning period (7:00 to 9:00 AM) and the weekday evening peak period (4:00 to 6:00 PM). Daily traffic counts were conducted on Clarks Road for a one day period using automatic traffic recorders (ATR).

The traffic-volume data gathered as part of this study was collected during the month of February 2016. Data from the MassDOT was reviewed to determine the monthly variations of the traffic volumes. Based upon the available traffic count data, February volumes are slightly lower than average month conditions. To represent average month conditions, existing volumes were adjusted upward by a factor of 1.13.

Clarks Road, south of Macy Street was recorded to carry approximately 2,400 vehicles per day (vpd). During the weekday morning peak hour, approximately 225 vehicles per hour (vph) were recorded on Clarks Road and during the weekday evening peak hour, 286 vph were recorded.

In front of the site, during the weekday morning peak hour, approximately 2,321 vph were recorded on Macy Street west of the site and during the weekday evening peak hour, 2,434 vph were recorded.

### Motor Vehicle Crash Data

Motor vehicle crash data for the study area intersections and roadways were obtained from MassDOT from 2009 to 2013. The motor vehicle crash data was reviewed to determine crash trends in the study area. Fifty-five (55) crashes were reported during the five year interval at the study area intersections. Forty-seven crashes were reported at the intersection of Macy Street, Elm Street and Clarks Road and eight (8) crashes occurred at the existing main site driveway. No fatalities were reported.

## PROBABLE IMPACTS OF THE PROJECT

### No-Build Traffic Volumes

To determine the impact of site-generated traffic volumes generated by the project on the roadway network under future conditions, baseline traffic volumes in the study area were projected to the year 2023. Traffic volumes on the roadway network at that time, in the absence of the proposed project, would include existing traffic, new traffic due to general background traffic growth, and traffic related to specific developments by others expected to be completed by 2023. The Merrimack Valley Planning Commission was contacted to determine an appropriate growth rate. A one (1.0) percent compounded growth rate was used to develop future No-Build conditions. No other background projects were identified.

### Build Traffic Volumes

Site generated traffic was based on trip-generation data published by the ITE *Trip Generation* manual[1]. The proposed project will consist of a 16,000 gsf addition which will house 23 service bays for the repair of automobiles. Trip generation data for Land Use Code (LUC) 841 – Automobile Sales was reviewed.

During an average weekday, the proposed project is expected to generate a total of 516 vehicle trips (258 vehicles entering and 258 vehicles exiting). During the weekday morning peak hour, the proposed project is expected to generate a total of 31 vehicle trips (23 vehicles entering and 8 vehicles exiting) and during the weekday evening peak hour, a total of 54 vehicle trips (22 vehicles entering and 32 vehicles exiting).

## TRAFFIC OPERATIONS ANALYSIS

In order to assess the impacts of the proposed project on the roadway network, traffic operations analyses were performed at the study area intersections under 2016 Existing, 2023 No-Build and 2023 Build conditions. These analyses indicate that the proposed project will not result in a significant impact on traffic operations at the study area intersections over No-Build conditions.

## RECOMMENDATIONS

The Macy Street main site driveway should continue to permit entering movements from both directions on Macy Street. Exiting movements are currently restricted to right-turns only. It is recommended that the driveway geometry be modified to include a raised

[1] *Trip Generation,* Eighth Edition; Institute of Transportation Engineers; Washington, DC; 2009.

island and appropriate pavement markings to limit exiting movements to right-turns. A STOP sign should be placed on the driveway approach to Macy Street. Clear sight lines along the site frontage should be maintained.

The proposed Macy Street service vehicle driveway should permit entering movements from Macy Street eastbound (Macy Street is median divided at this location). Exiting movements will be restricted to right-turns out only and appropriate pavement markings and signage (NO LEFT TURN) installed. A STOP sign should be placed on the driveway approach to Macy Street. Clear sight lines along the site frontage should be maintained.

## SUMMARY

Review of the proposed project and the access plan shows that in relation to roadway capacity, traffic safety, and traffic impacts upon the surrounding roadway network, the proposed project will meet safety standards and have a minimal impact on existing traffic conditions. With the proposed access, and maintaining sight distances from the driveways (clear sight lines along frontage), safe and efficient access can be provided to the patrons of the proposed project and to the motoring public in the area.

# SECTION 2: EXISTING TRAFFIC CONDITIONS

## STUDY AREA

Roadway geometry and traffic control information was collected for the following locations:

- Macy Street, Elm Street and Clarks Road
- Macy Street and existing main site driveway

## FIELD SURVEY

A comprehensive field inventory of the proposed site was conducted in February 2016. The inventory included collection of existing roadway geometrics, traffic volumes, and safety data for the existing study area intersections and site access driveway locations. Traffic volumes were measured by means of automatic traffic recorder (ATR) counts and substantiated by manual turning movement counts (TMCs) conducted at the study area intersections.

## GEOMETRICS

Primary study area roadways are described below.

### Roadways

#### Macy Street (Route 110)

Route 110 is generally a collector roadway under the jurisdiction of the Massachusetts Department of transportation (MassDOT). In the vicinity of the site, Route 110 classified functionally as an Urban Minor Arterial. Route 110 traverses northeastern Massachusetts in an east-west direction from its eastern terminus at Route 1 in Salisbury

to its western terminus at Route 12 in West Boylston. In the study area, Route 110 is a two-lane roadway. Additional turn lanes are provided at major signalized intersections. The posted speed limit is 40 miles per hour (mph). Illumination is provided by way of street lights mounted on poles. Land use along route 110 in the study area is a mix of retail and restaurant uses.

### Clarks Road

Clarks Road is a local street extending in a north/south direction from Macy Street southerly to Main Street. Clarks Road is under the City of Amesbury jurisdiction. Clarks Road provides one travel lane per direction, separated by a double yellow centerline. Sidewalks are provided along the east side of the road in the vicinity of the site. The posted speed limit is 30 mph. Land use along Clarks Road is a mix of commercial uses near Macy Street and residential uses south of the site.

## Intersections

### Macy Street, Elm Street and Clarks Road

Elm Street intersects Route 110 from the north and Clarks Road intersects from the south to form this four-legged, signalized intersection. The Route 110 eastbound approach consists of an exclusive left-turn lane and two through lanes, permitting right turns. The Route 110 westbound approach consists of an exclusive left-turn lane, two through lanes and an exclusive, channelized right-turn lane. The Elm Street approach consists of two exclusive left-turn lanes and a shared through/right-turn lane. The Clarks Road approach consists of an exclusive left-turn lane and a shared through/right-turn lane. A sidewalk exists along the east side of Clarks Road approaching the intersection, both sides of Route 110 E. of the intersection and along the east side of Elm Street. A crosswalk exists across the Route 110 westbound approach to the intersection and across channelized right-turn lane. Land use in the vicinity intersection consists of a gas station and convenience store, open space, a Friendly's restaurant and a Burger King restaurant. Traffic at the intersection is controlled by a three-phase traffic actuated signal with advances for the Route 110 eastbound and westbound exclusive left-turn lanes.

### Macy Street and Amesbury Chevrolet Main Site Driveway

This unsignalized intersection is under the jurisdiction of the Town of Amesbury. Macy Street forms the east and west legs of the intersection and the driveway forms the south leg. The Macy Street eastbound approach consists of two lanes permitting right-turns. The Macy Street westbound approach consists of an exclusive left-turn lane and two through lanes. The driveway approach consists of a single lane and is signed to permit right-turns only. Sidewalks are present on the north side of Macy Street at the intersection. The driveway operates under STOP-like control. Land use at the intersection consists of the existing Amesbury Chevrolet site and wooded land.

## TRAFFIC VOLUMES

### Existing Traffic Volumes

To establish base traffic conditions within the study area, manual turning movement and vehicle classification counts were obtained in February 2016. Peak-period turning movement counts were conducted on Thursday, February 11, 2016 during the weekday morning and evening peak periods (7:00 to 9:00 AM and 4:00 to 6:00 PM) at the following intersections:

- Macy Street, Elm Street and Clarks Road
- Macy Street and existing main site driveway

Daily traffic counts were conducted on Clarks Road for a one day period using automatic traffic recorders (ATR).

Analysis of the peak-period traffic counts indicated that the weekday morning commuter peak hour generally occurs between 7:30 AM and 8:30 AM and the weekday evening commuter peak generally hour occurs between 4:30 and 5:30 PM. The traffic count worksheets are provided in the Appendix.

### Seasonal Adjustment

The traffic-volume data gathered as part of this study was collected during the month of February 2016. Available traffic volume data from the MassDOT was reviewed to determine the monthly variations of the traffic volumes. The traffic data showed February volumes to be slightly lower than average month conditions. Therefore, the February traffic volumes were adjusted upward by a factor of 1.13 to represent average month conditions. The 2016 existing weekday daily and peak-hour traffic volumes for average-month conditions are summarized below in Table 1. The 2016 Existing weekday morning and weekday evening peak hour traffic flow networks are shown graphically on Figure 2. The seasonal worksheets are provided in the Appendix.

**TABLE 1**
**EXISTING WEEKDAY TRAFFIC-VOLUME SUMMARY[a]**

| Location | Daily Traffic Volume[b] | Weekday Morning Peak Hour | | | Weekday Evening Peak Hour | | |
|---|---|---|---|---|---|---|---|
| | | Traffic Volume[c] | K Factor[d] | Directional Distribution[e] | Traffic Volume | K Factor | Directional Distribution |
| Clarks Road, south of Macy Street | 2,400 | 225 | 9.3 | 61.3% NB | 286 | 11.9 | 52.4% SB |

[a]Two-way traffic volume.
[b]Daily traffic expressed in vehicles per day.
[c]Expressed in vehicles per hour.
[d]Percent of daily traffic volumes which occurs during the peak hour.
[e]Percent of peak-hour volume in the predominant direction of travel.
NB = northbound; SB = southbound; EB = eastbound; WB = westbound.

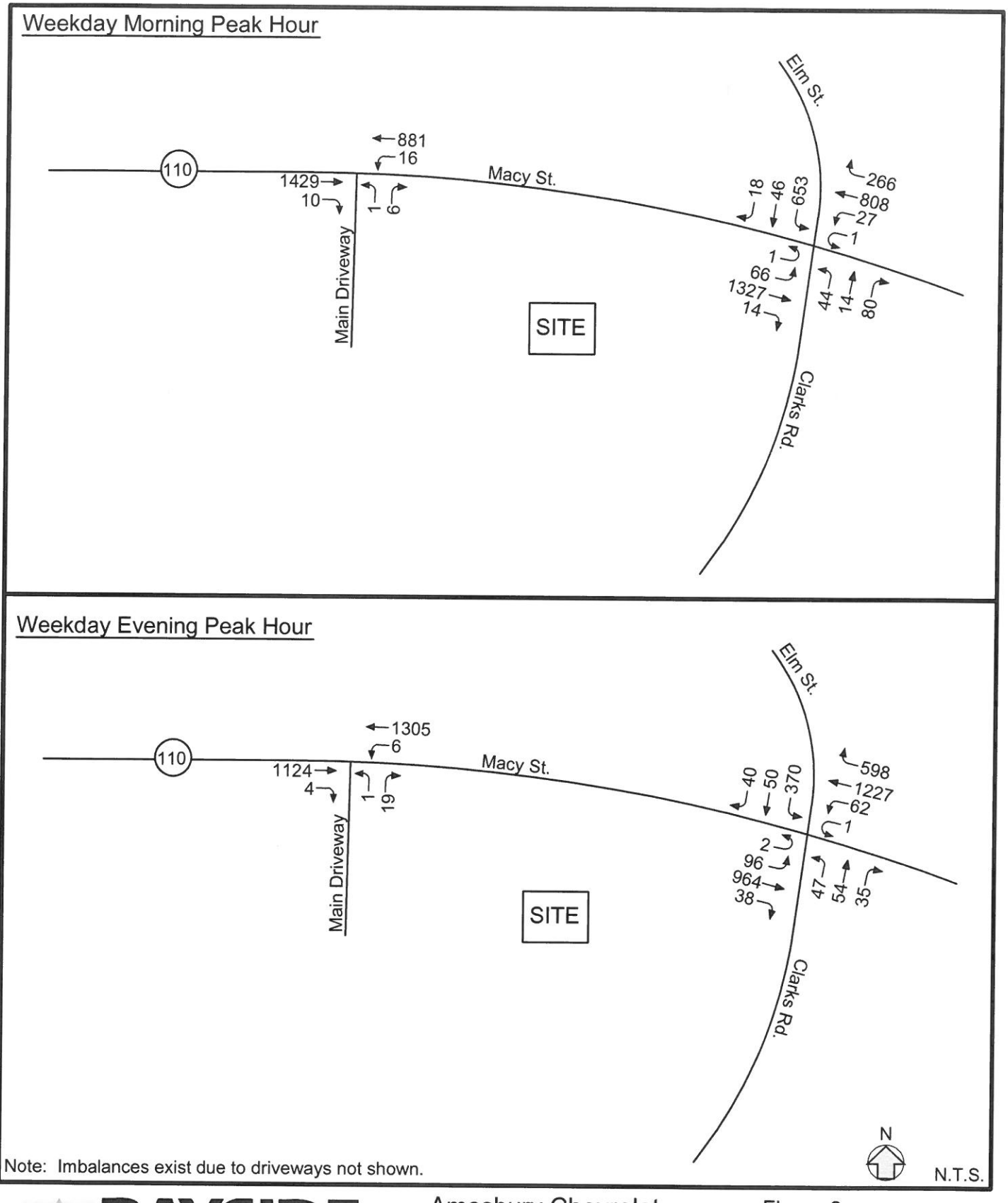


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Figure 2

2016 Existing
Peak Hour Traffic Volumes

Clarks Road, south of Macy Street was recorded to carry approximately 2,400 vehicles per day (vpd). During the weekday morning peak hour, approximately 225 vehicles per hour (vph) were recorded and during the weekday evening peak hour, 286 vph were recorded.

## MOTOR VEHICLE CRASH DATA

Motor vehicle crash data for the study area intersections and roadways were obtained from the MassDOT for 2009 through 2013. Fifty-five (55) crashes were reported during the five year interval at the study area intersections. Over the 5 year period, forty-seven (47) crashes were reported at Macy Street and Clarks Road (average of 9.4 crashes per year) and eight (8) crashes at Macy Street and the Amesbury Chevrolet driveway (average of 1.6 crashes per year).

Most of the crashes occurred at the intersection of Macy Street, Elm Street and Clarks Road intersection. Of these crashes, eighteen (18) were angle type collisions, sixteen (16) were rear-end collisions, ten (10) were sideswipe collisions, two (2) were head-on collisions and one (1) was a single vehicle crash. No fatalities were reported. The crash data is included in the Appendix. The crash data is summarized in Table 2.

None of the intersections experienced a significant crash rate.

## TABLE 2
## MOTOR VEHICLE CRASH DATA SUMMARY[a]

| Scenario | Location: Macy Street/ Elm Street/ Clarks Road | Location: Macy Street/ Amesbury Chevrolet Driveway |
|---|---|---|
| *Year*[b]: | | |
| 2009 | 8 | 0 |
| 2010 | 8 | 1 |
| 2011 | 12 | 2 |
| 2012 | 8 | 3 |
| 2013 | 11 | 2 |
| Total | 47 | 8 |
| Average[b] | 9.4 | 1.6 |
| Crash Rate[c] | 0.65 | 0.16 |
| Significant[d] | No | No |
| *Type:* | | |
| Angle | 18 | 1 |
| Rear-End | 16 | 6 |
| Head-On | 2 | 0 |
| Sideswipe | 10 | 1 |
| Single Vehicle Crash | 1 | 0 |
| Bicycle | 0 | 0 |
| Unknown | 0 | 0 |
| Total | 47 | 8 |
| *Time of Day:* | | |
| Morning (7:00 to 9:00 AM) | 2 | 4 |
| Evening (4:00 to 6:00 PM) | 8 | 1 |
| Remainder of Day | 37 | 3 |
| Total | 47 | 8 |
| *Pavement Conditions:* | | |
| Dry | 36 | 8 |
| Wet | 10 | 0 |
| Snow/Ice/Slush | 1 | 0 |
| Unknown | 0 | 0 |
| Total | 47 | 12 |
| *Severity:* | | |
| Property Damage Only | 40 | 6 |
| Personal Injury | 7 | 2 |
| Fatal Accident | 0 | 0 |
| Unknown | 0 | 0 |
| Total | 47 | 8 |

[a]Source: MassDOT.
[b]Average crashes over analysis period.
[c]Crash rate per million entering vehicles (mev).
[d]Signalized intersections are significant if rate >0.77 crashes per million vehicles, and unsignalized intersections are significant if rate >0.58 crashes per million vehicles.

## VEHICLE SPEEDS

Existing speed data for Clarks Road were also collected using LIDAR. The speed data is summarized in Table 3.

**TABLE 3**
**OBSERVED VEHICLE SPEEDS**

| Direction | Posted Speed Limit (mph) | Average Observed Speed[a] (mph) | 85th Percentile Speed (mph) |
|---|---|---|---|
| Clarks Road Northbound | 30 | 32 | 36 |
| Clarks Road Southbound | 30 | 30 | 35 |

[a]Based on speed data compiled in February 2016.

As shown in Table 3, the average speed of vehicles travelling northbound or southbound was found to be 32 and 30 mph respectively on Clarks Road. The 85th percentile speed was found to be 36 mph for northbound vehicles and 35 mph for southbound vehicles. The 85th percentile speed is the speed at which sight distances are typically evaluated.

## PUBLIC TRANSPORTATION

Public transportation services are provided within the study area by the Merrimack Valley Transportation Authority (MVRTA). The MVRTA operates Bus service through Amesbury on Macy Street (Bus Route 54). Route 558 provides access from the Nicholas Costello Transportation Center in Amesbury to Newburyport to Salisbury Beach to the east. The closest bus stop to the Project on the Route 54 bus line is located at the Stop & Shop in Carriagetown Marketplace on Macy Street. Route 54 bus service is provided Monday through Sunday from approximately 6:23 AM to 7:05 PM. The MVRTA schedule information is included in the Appendix.

## PLANNED ROADWAY IMPROVEMENTS

Officials for the City of Amesbury were contacted regarding roadway improvements planned for the study area intersections. No capacity related improvements are currently planned.

# SECTION 3:
# FUTURE NO-BUILD AND BUILD TRAFFIC CONDITIONS

To determine the impact of site-generated traffic volumes on the roadway network under future conditions, baseline traffic volumes in the study area were projected to the year 2023. Traffic volumes on the roadway network at that time, in the absence of the proposed project, would include existing traffic, new traffic due to general background traffic growth, and traffic related to specific developments by others expected to be completed by 2023. Consideration of these factors resulted in the development of 2023 No-Build traffic volumes. Anticipated site-generated traffic volumes were then superimposed upon these No-Build traffic flow networks to develop the 2023 Build conditions.

## FUTURE 2023 NO-BUILD TRAFFIC VOLUMES

Traffic growth on area roadways is a function of the expected land development in the immediate area as well as the surrounding region. Several methods can be used to estimate this growth. A procedure frequently employed estimates an annual percentage increase in traffic growth and applies that percentage to all traffic volumes under study. The drawback to such a procedure is that some turning volumes may actually grow at either a higher or a lower rate at particular intersections.

An alternative procedure identifies the location and type of planned development, estimates the traffic to be generated, and assigns it to the area roadway network. This produces a more realistic estimate of growth for local traffic. However, the drawback of this procedure is that the potential growth in population and development external to the study area would not be accounted for in the traffic projections.

To provide a conservative analysis framework, both procedures were used.

## Background Traffic Growth

Traffic-volume data compiled by MassDOT from permanent count stations and historic traffic counts in the area were reviewed in order to determine traffic growth trends. Based on a review of this data, it was determined that traffic volumes within the study area have shown little growth or generally decreased over the past several years. The Merrimack Valley Planning Commission (MVPC) was contacted to determine an appropriate growth factor. Based on the MVPC, a one (1) percent growth rate is appropriate for the Route 110 corridor in Amesbury. Therefore, a one (1.0) percent per year compounded annual background traffic growth rate was used to account for potential future traffic growth external to the study area and presently unforeseen development. The MassDOT data is contained in the Appendix.

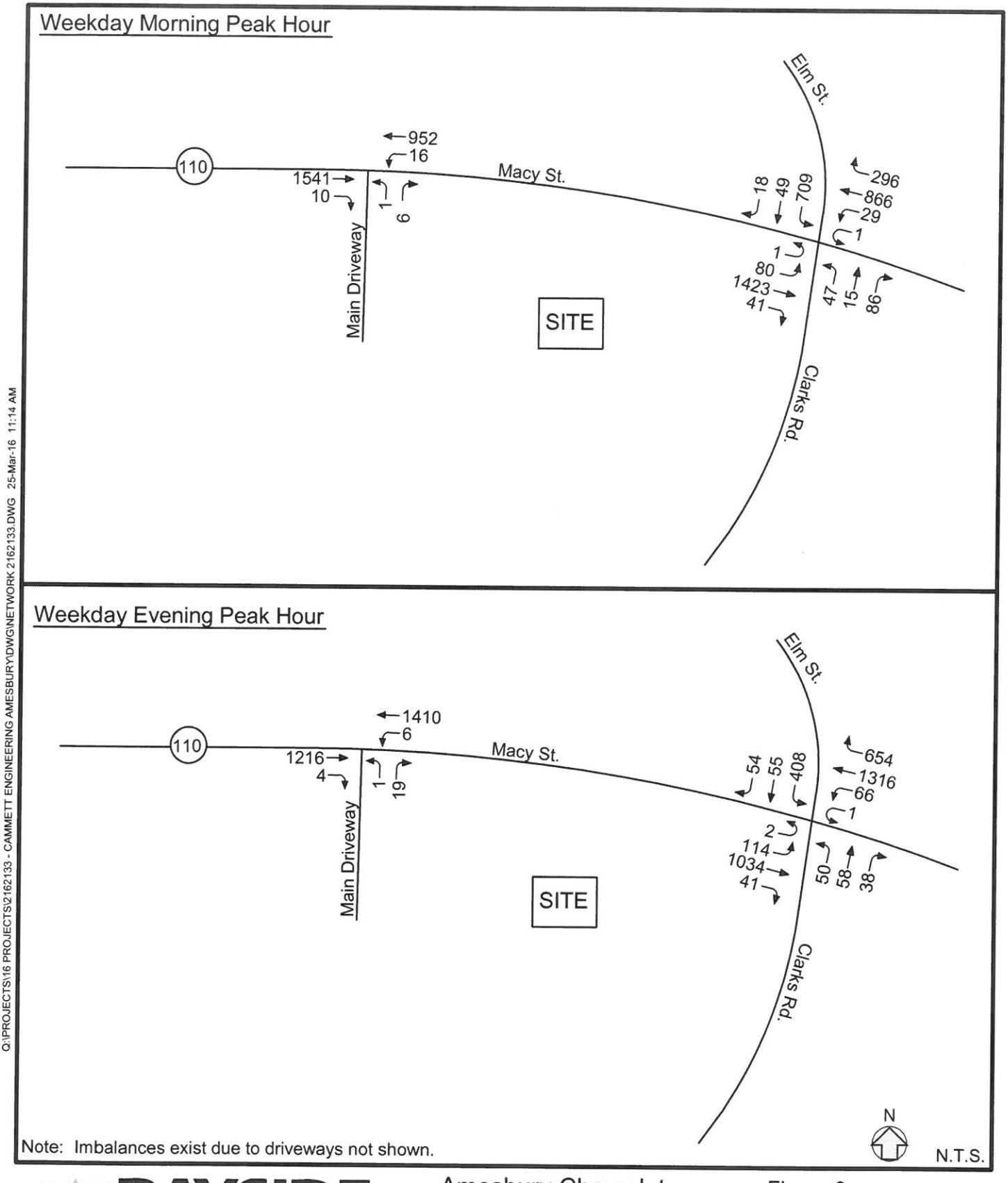
## Specific Development by Others

Traffic volumes generated by the specific local developments by others were included in the 2023 No-Build condition. The City of Amesbury was contacted to identify specific planned developments. Based on these discussions, there is one project that is underway that would impact future volumes. This is the proposed hotel and retail development on Elm Street, which is currently under construction. Trips for this project were obtained from the August 2010 Traffic Impact and Access Study[2] and are included in the Appendix.

## No-Build Condition Traffic Volumes

The 2023 No-Build weekday morning and weekday evening peak-hour traffic volumes were developed by applying a compounded one (1.0) percent annual growth rate to the 2016 Existing through peak-hour traffic volumes and adding traffic from the identified background project. Figure 3 shows the projected 2023 No-Build peak hour traffic volumes for the respective weekday morning and weekday evening peak-hours.

[2] *Traffic Impact and Access Study Proposed Mixed-Use Development;* Traffic Solutions; Boston, MA; August 2010.




Note: Imbalances exist due to driveways not shown.

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Figure 3

2023 No-Build
Peak Hour Traffic Volumes

## FUTURE 2017 BUILD CONDITIONS

### Project Description

As currently proposed, the project will consist of razing of the existing building in the northeast corner of the site and the construction of a new addition to the building. The addition will consist of 16,000 gsf of space and will contain twenty-three (23) service bays. Access to the site will be provided by way of the existing main driveway to Macy Street and a secondary, service vehicle access driveway located at the easterly edge of the site. The service driveway is designed for delivery of parts and other materials associated with the sale and repair of automobiles.

### Site Traffic Generation

Site generated traffic for the project was based on trip-generation data published by the Institute of Transportation Engineers (ITE) in the *Trip Generation* manual[3]. Trip generation data for Land Use Code (LUC) 841 – Automobile Sales was reviewed. The preliminary trip generation for the project is summarized in Table 4 and the trip generation worksheets are included in the Appendix.

**TABLE 4**
**TRIP-GENERATION SUMMARY**

| | Proposed Expansion Space[a] |
|---|---|
| ***Daily*** | 516 |
| ***Weekday Morning Peak Hour:*** | |
| Entering | 23 |
| Exiting | 8 |
| Total | 31 |
| ***Weekday Evening Peak Hour:*** | |
| Entering | 22 |
| Exiting | 32 |
| Total | 54 |

[a]Based on ITE LUC 841, Automobile Sales; 16,000 sf.

Not all of the trips expected to be generated by the proposed development will represent new trips on the study area roadway system. According to the ITE Trip Generation Handbook, a portion of these trips can be considered pass-by trips. That is, they are not considered primary trips of site generated traffic, but consist of vehicles passing by the

[3]*Trip Generation,* Ninth Edition; Institute of Transportation Engineers; Washington, DC; 2012.

site on their way to another destination. The ITE Trip Generation Handbook does not contain data on pass-by trips for automobile dealerships. Therefore, no pass-by credit was taken for the additional trips.

During an average weekday, the proposed project is expected to generate a total of 516 vehicle trips (258 vehicles entering and 258 vehicles exiting). During the weekday morning peak hour, the proposed project is expected to generate a total of 31 vehicle trips (23 vehicles entering and 8 vehicles exiting) and during the weekday evening peak hour, a total of 54 vehicle trips (22 vehicles entering and 32 vehicles exiting).

## Trip Distribution

The directional distribution of the vehicular traffic approaching and departing the site is a function of population densities, the location of employment, existing travel patterns, similar uses, and the efficiency of the existing roadway system. Existing traffic flows were reviewed to determine the expected trip distribution pattern. Table 5 summarizes the expected trip distribution.

**TABLE 5**
**PROPOSED TRIP DISTRIBUTION**

| Route | Direction | Percent of Trips |
|---|---|---|
| Macy Street | East | 53% |
| Macy Street | West | 39% |
| Clarks Road | South | 4% |
| Elm Street | North | 4% |
| Total | | 100 % |

## Future Traffic Volumes - Build Condition

The site-generated traffic was distributed within the study area according to the percentages summarized in Table 5. Figure 4 shows the site-generated traffic volumes associated with the project. The site generated volumes were then superimposed onto the 2023 No-Build traffic volumes to represent the 2023 Build traffic-volume conditions. The anticipated 2023 Build weekday morning and weekday evening traffic volumes are

graphically presented in Figure 5. These volumes were used as the basis for all analysis as well as to identify potential mitigation measures to ameliorate the project's impacts.

A summary of 2023 peak-hour projected traffic-volume changes in the site vicinity are shown in Table 6. These volumes are based on the expected increases from the site traffic generation.

**TABLE 6**
**TRAFFIC-VOLUME INCREASES[a]**

| Location/Peak Hour | 2023 No-Build | 2023 Build | Volume Increase over No-Build | Percent Increase over No-Build |
|---|---|---|---|---|
| ***Macy Street, west of Site*** | | | | |
| Weekday Morning | 2,504 | 2,515 | 11 | 0.4 |
| Weekday Evening | 2,631 | 2,652 | 21 | 0.8 |
| ***Macy Street, east of Elm Street*** | | | | |
| Weekday Morning | 3,411 | 3,423 | 12 | 0.4 |
| Weekday Evening | 3,518 | 3,547 | 29 | 0.8 |
| ***Clarks Road, south of Macy Street*** | | | | |
| Weekday Morning | 267 | 271 | 4 | 1.5 |
| Weekday Evening | 308 | 310 | 2 | 0.6 |
| ***Elm Street, north of Macy Street*** | | | | |
| Weekday Morning | 1,167 | 1,171 | 4 | 0.3 |
| Weekday Evening | 1,343 | 1,345 | 2 | 0.1 |

[a]All volumes are vehicles per hour, total of both directions.

As shown in Table 6, project-related increases are in the range of 2 to 29 bi-directional vehicles during the peak hours. This is approximately equivalent to one additional vehicle every four minutes or less per direction on average during the peak hours.

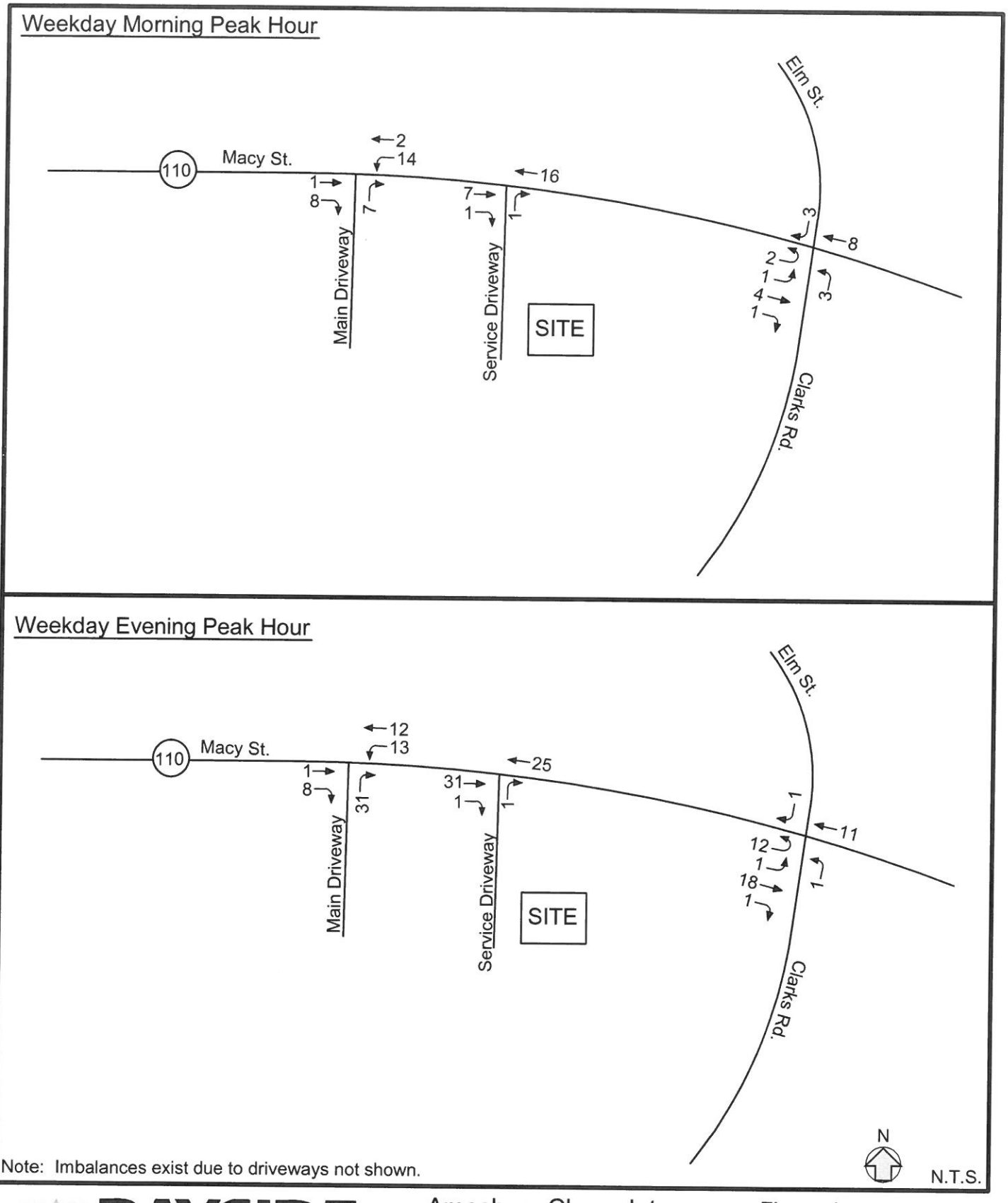


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Figure 4

Site Generated
Peak Hour Traffic Volumes

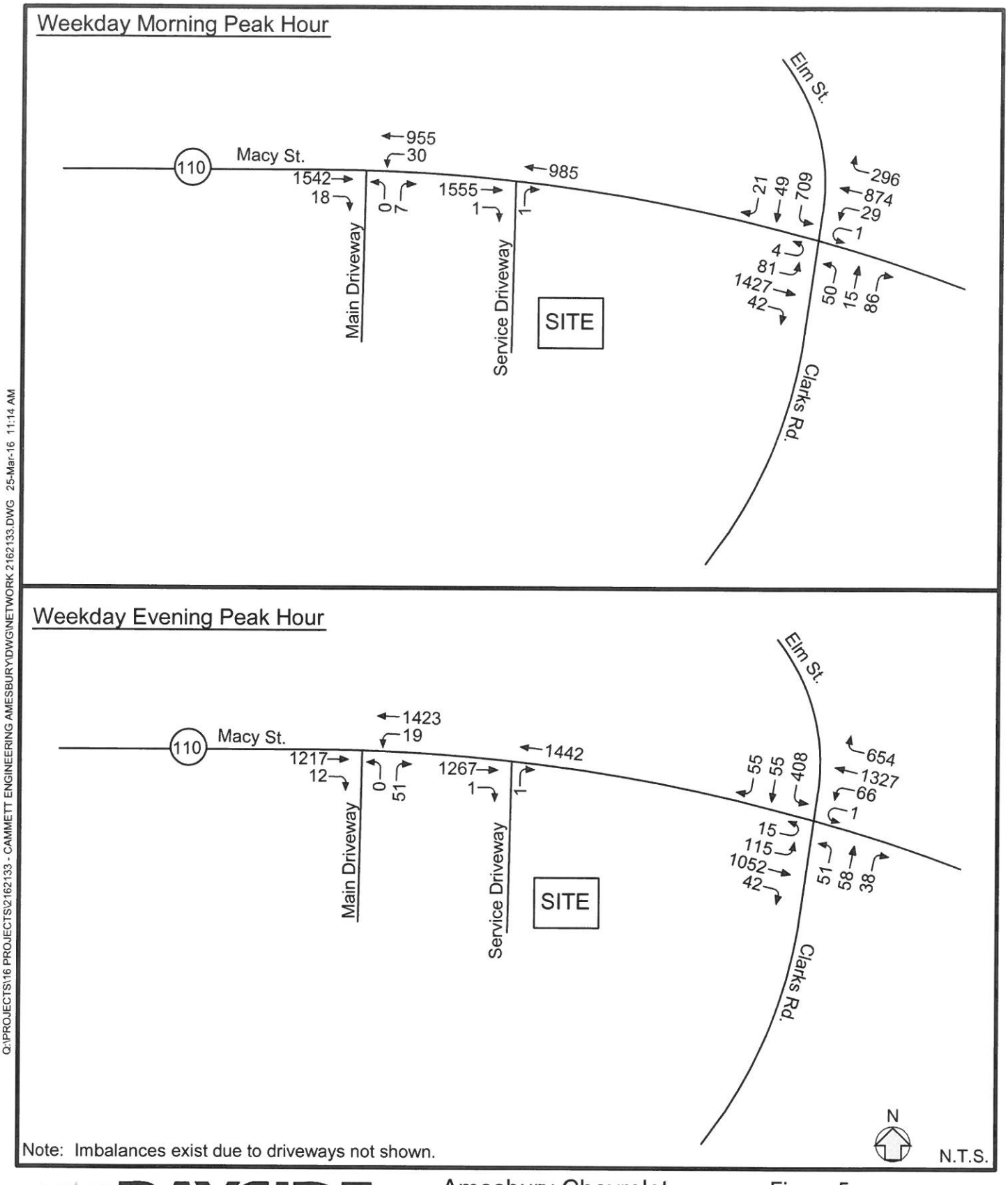


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Figure 5

2023 Build
Peak Hour Traffic Volumes

# SECTION 4: ANALYSIS

To assess intersection operations, capacity analyses were conducted for Existing, No-Build, and Build traffic-volume conditions. Capacity analyses provide an indication of how well the study area intersections serve existing and projected traffic volumes. Vehicle queue analyses provide a secondary measure of the operational characteristics of an intersection or section of roadway under study in terms of lane use and demand.

## METHODOLOGY

### Levels of Service

Level of service (LOS) is a quantitative measure used to describe the operation of an intersection or roadway segment. The level of service definition is described by the quality of traffic flow and is primarily defined in terms of traffic delays. The primary result of capacity analyses[4] is the assignment of a level of service to traffic intersections or roadway segments under various traffic-flow conditions. Six levels of service are defined for traffic intersections and roadway segments. Levels of service range from LOS A to LOS F. LOS A represents very good operating conditions and LOS F represents very poor operating conditions.

### Signalized Intersections

Levels of service for signalized intersections are calculated using the methodology and procedures described in the 2010 *Highway Capacity Manual*. The methodology assesses the intersection based on type of signal operation, signal timing and phasing, progression, vehicle mix, and intersection geometrics. Level-of-service designations are based on the delay per vehicle. Table 7 summarizes the relationship between level of service and delay. The calculated delay values result in level-of-service designations which are

[4]The capacity analysis methodology is based on procedures presented in the *Highway Capacity Manual;* Transportation Research Board; Washington, DC; 2010.

applied to individual lane groups, to individual intersection approaches, and to the entire intersection. In the 2010 HCM methodology, the critical lane group volume to capacity ratio is reported.

**TABLE 7**
**LEVEL-OF-SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS[a]**

| Delay per Vehicle (Seconds) | Resulting Level of Service $v/c^b < 1.0$ | Resulting Level of Service $v/c^b > 1.0$ |
|---|---|---|
| ≤10.0 | A | F |
| 10.1 to 20.0 | B | F |
| 20.1 to 35.0 | C | F |
| 35.1 to 55.0 | D | F |
| 55.1 to 80.0 | E | F |
| >80.0 | F | F |

[a]*Highway Capacity Manual*; Transportation Research Board; Macy, DC; 2010; page 18-6.
[b]Volume to capacity ratio.

## Unsignalized Intersections

The level of service for an unsignalized intersection is determined by the methodology and procedures described in the 2010 *Highway Capacity Manual.*[5] The level of service for unsignalized intersections is measured in terms of average delay for the critical movements (typically side street turning movements or mainline turning movements). The delay for the critical movements is a function of the available capacity for the movement and the degree of saturation of the lane group containing the critical movement. The delay calculation includes the effects of initial deceleration delay approaching a STOP sign, stopped delay, queue move-up time, and final acceleration delay from a stopped condition. The definitions for level of service at unsignalized intersections are also provided in the 2010 *Highway Capacity Manual.* Table 8 summarizes the relationship between level of service and average control delay for the critical movements at unsignalized intersections.

[5]*Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2010.

**TABLE 8**
**LEVEL-OF-SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS[a]**

| Average Delay (seconds per vehicle) | Resulting Level of Service v/c[b] < 1.0 | Resulting Level of Service v/c > 1.0 |
|---|---|---|
| ≤ 10.0 | A | F |
| 10.1 to 15.0 | B | F |
| 15.1 to 25.0 | C | F |
| 25.1 to 35.0 | D | F |
| 35.1 to 50.0 | E | F |
| >50.0 | F | F |

[a]*Highway Capacity Manual*; Transportation Research Board; Elm, DC; 2010; page 19-2
[b]Volume to capacity ratio.

The analytical methodologies used for the analysis of unsignalized intersections use conservative analysis parameters, such as high critical gaps. The critical gap is defined as the minimum time between successive main line vehicles for a side street vehicle to execute the appropriate turning maneuver. Actual field observations indicate that drivers on minor streets accept smaller gaps in traffic than those used in the analysis procedures and therefore experience less delay than calculated by the HCM methodology. **The analysis results overstate the actual delays experienced in the field.** It should be noted that the unsignalized intersections along heavily trafficked roadways operate at constrained levels and the resulting calculated results of the unsignalized intersection analyses should be considered highly conservative.

## CAPACITY ANALYSIS RESULTS

Level-of-service analyses were conducted for 2016 Existing, 2023 No-Build, and 2023 Build conditions for the intersections within the study area. The results of the 2023 signalized analyses are summarized in Table 9 and the unsignalized analyses are summarized in Table 10. Detailed analysis sheets are presented in the Appendix.

## TABLE 9
## SIGNALIZED LEVEL-OF-SERVICE ANALYSIS SUMMARY
## MACY STREET, EAST STREET AND ROSEDALE ROAD

| Signalized Intersection/ Peak Hour/Lane Group | 2016 Existing | | | 2023 No-Build | | | 2023 Build | | |
|---|---|---|---|---|---|---|---|---|---|
| | V/C[a] | Delay[b] | LOS[c] | V/C | Delay | LOS | V/C | Delay | LOS |
| **Macy Street Elm Street and Clarks Road** | | | | | | | | | |
| Weekday Morning | | | | | | | | | |
| Eastbound Lt | 0.47 | 60.7 | E | 0.54 | 63.9 | E | 0.56 | 64.6 | E |
| Eastbound Th/Rt | 0.86 | 34.2 | C | 0.95 | 43.3 | D | 0.95 | 43.9 | D |
| Westbound Lt | 0.25 | 58.1 | E | 0.27 | 59.3 | E | 0.27 | 59.6 | E |
| Westbound Th | 0.59 | 27.8 | C | 0.64 | 29.8 | C | 0.69 | 31.7 | C |
| Westbound Rt | 0.24 | 1.3 | A | 0.26 | 1.3 | A | 0.27 | 1.3 | A |
| Northbound Lt | 0.38 | 59.7 | E | 0.40 | 61.2 | E | 0.42 | 62.1 | E |
| Northbound Th/Rt | 0.51 | 23.0 | C | 0.53 | 23.5 | C | 0.53 | 23.3 | C |
| Southbound Lt | 0.74 | 16.8 | D | 0.78 | 49.2 | D | 0.79 | 49.4 | D |
| Southbound Th/Rt | 0.75 | 53.4 | D | 0.78 | 55.9 | E | 0.79 | 57.1 | E |
| **Overall** | -- | **34.2** | **C** | -- | **38.8** | **D** | -- | **39.8** | **D** |
| Weekday Evening | | | | | | | | | |
| Eastbound Lt | 0.57 | 59.2 | E | 0.68 | 66.3 | E | 0.73 | 70.6 | E |
| Eastbound Th/Rt | 0.63 | 23.3 | C | 0.66 | 24.5 | C | 0.67 | 24.7 | C |
| Westbound Lt | 0.41 | 54.6 | D | 0.45 | 56.7 | E | 0.45 | 56.9 | E |
| Westbound Th | 0.78 | 28.2 | C | 0.86 | 33.6 | C | 0.87 | 34.4 | C |
| Westbound Rt | 0.63 | 8.9 | A | 0.70 | 11.3 | B | 0.70 | 11.5 | B |
| Northbound Lt | 0.37 | 51.0 | D | 0.40 | 52.2 | D | 0.41 | 52.4 | D |
| Northbound Th/Rt | 0.63 | 51.8 | D | 0.70 | 56.9 | E | 0.70 | 57.1 | E |
| Southbound Lt | 0.64 | 47.8 | D | 0.72 | 52.1 | D | 0.73 | 52.4 | D |
| Southbound Th/Rt | 0.62 | 49.6 | D | 0.69 | 53.0 | D | 0.69 | 53.6 | D |
| **Overall** | -- | **28.8** | **C** | -- | **32.4** | **C** | -- | **33.0** | **C** |

[a]Maximum volume-to-capacity ratio.
[b]Delay in seconds per vehicle.
[c]Level of service.
Lt = Left; Th = Through; Rt = Right.

## TABLE 10
## UNSIGNALIZED LEVEL-OF-SERVICE ANALYSIS SUMMARY

| Critical Movement/ Peak Hour | 2016 Existing | | | | 2023 No-Build | | | | 2023 Build | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Demand[a] | V/C[b] | Delay[c] | LOS[d] | Demand | V/C | Delay | LOS | Demand | V/C | Delay | LOS |
| ***Macy Street and Existing Site Driveway*** | | | | | | | | | | | | |
| *All movements from driveway:* | | | | | | | | | | | | |
| Weekday Morning | 7 | 0.05 | 17.5 | C | 7 | 0.05 | 18.8 | C | 14 | 0.05 | 17.4 | C |
| Weekday Evening | 20 | 0.10 | 17.2 | C | 20 | 0.11 | 19.1 | C | 51 | 0.20 | 19.7 | C |
| ***Macy Street and Proposed Clarks Road Driveway*** | | | | | | | | | | | | |
| *All movements from exit:* | | | | | | | | | | | | |
| Weekday Morning | -- | -- | -- | -- | -- | -- | -- | -- | 1 | 0.03 | 27.9 | D |
| Weekday Evening | -- | -- | -- | -- | -- | -- | -- | -- | 1 | 0.02 | 21.1 | C |

[a]Demand of critical movements in vehicles per hour.
[b]Volume-to-capacity ratio.
[c]Delay in seconds per vehicle.
[d]Level of service.
[e]Delay not representative of actual conditions when v/c is greater than 1.00.

### Macy Street, Elm Street and Clarks Road

Under 2016 Existing weekday morning peak hour conditions, this signalized intersection currently is modeled to operate at level of service (LOS) C and at LOS C during the weekday evening peak hour. Under future 2023 No-Build conditions, this intersection is projected to operate at LOS D during the weekday morning peak hour and at LOS C during the weekday evening peak hour. Under future 2023 Build conditions, this intersection is projected to continue to operate at LOS D during the weekday morning peak hour and at LOS C during the weekday evening peak hour.

### Macy Street and Main Site Driveway

Under 2016 Existing conditions, the critical movements at this unsignalized intersection (all movements out of the driveway) are modeled to operate at LOS C during the weekday morning peak hour and at LOS C during the weekday evening peak hour. Under future 2023 No-Build conditions, the critical movements are projected to continue to operate at LOS C during the weekday morning and weekday evening peak hours. Under 2023 Build conditions, with the project, the critical movements are projected to continue to operate at LOS C during the weekday morning and weekday evening peak hours.

### Macy Street and Service Driveway

Under 2023 Build conditions, with the project, the critical movements (right-turn movements out of the driveway are projected to operate at LOS D during the weekday morning peak hour and at LOS C during the weekday evening peak hour.

# SECTION 5: RECOMMENDATIONS AND CONCLUSION

## RECOMMENDATIONS

The final phase of the analysis process is to identify the mitigation measures necessary to minimize the impact of the project on the transportation system. The proponent has made a commitment to implement the mitigation measures listed below.

The capacity analyses performed for the unsignalized study area intersections indicate that generally, the new project trips will not significantly impact intersection operations. There is no reduction in levels of service at the study area intersections (except for the proposed site driveways). While the analysis shows the site driveways to operate at a poor level of service, actual conditions are expected to better than the capacity analysis model indicates. This is due to the conservative nature of the modeling algorithms, as well as the gaps created in the Macy Street traffic stream due to the existing signals at Clarks Road and at Carriagetown Marketplace.

As a result of the additional traffic generation being relatively low, it is not expected that the project will have a significant impact on intersection operations in the study area.

The Macy Street main site driveway should continue to permit entering movements from both directions on Macy Street. Exiting movements are currently restricted to right-turns only. It is recommended that the driveway geometry be modified to include a raised island and appropriate pavement markings to limit exiting movements to right-turns. A STOP sign should be placed on the driveway approach to Macy Street. Clear sight lines along the site frontage should be maintained.

The proposed Macy Street service vehicle driveway should permit entering movements from Macy Street eastbound (Macy Street is median divided at this location). Exiting movements will be restricted to right-turns out only and appropriate pavement markings and signage (NO LEFT TURN) installed. A STOP sign should be placed on the driveway approach to Macy Street. Clear sight lines along the site frontage should be maintained.

## CONCLUSION

Review of the proposed project and the access plan shows that in relation to roadway capacity, traffic safety, and traffic impacts upon the surrounding roadway network, the proposed project will have a minimal impact on existing traffic conditions. With the proposed access, and maintaining sight distances from the driveways (clear sight lines along frontage), safe and efficient access can be provided to the patrons of the proposed project and to the motoring public in the area.